Lochsa Atlas Restoration Prioritization Framework:

Summary Report and User's Manual

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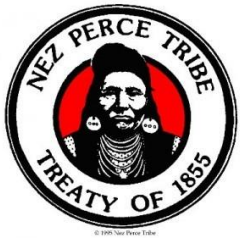

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GLOSSARY

Alluvial – a deposit of unconsolidated sediments left by flowing streams in a river channel, delta, estuary, or floodplain.

Biologically Significant Reaches (BSRs) – a geographic area comprised of stream reaches with similar fish use and limiting factor characteristics used to aid in determining priority restoration work areas.

Channel Stability – a general term that refers to the resistance of bed and bank erosion in a river in response to changes in flow or sediment transport. Natural stream channels have varying degrees of stability. A naturally stable channel has the ability to transport water and sediment over time without an overall net increase in aggradation or incision. Under this definition, streams may migrate laterally if they maintain their natural dimensions (width, depth), pattern (sinuosity), and profile (gradient and bed features).

Channel Substrate – the composition of the river channel bed materials within the active channel.

Clean Water Act (CWA) – the primary federal law in the United States governing water pollution.

Confinement – a general term used to describe the degree to which a stream is laterally contained. Confinement boundaries may include natural high terraces and hillslopes, or artificial features such as levees.

Diversion Screen – devices installed at surface water diversions to physically preclude passage of fish into the intake to prevent injury and entrainment.

Embeddedness – the extent to which larger cobbles or gravel are surrounded by or covered by fine sediment.

Endangered Species Act (ESA) – a 1973 Act of Congress that mandated that endangered and threatened species of fish, wildlife, and plants be protected and restored.

Enhancement –actions designed to increase, or further improve the quality, value, or extent of particular habitat features that are already present.

Entrenchment – the degree to which a stream is vertically confined from its floodplain. Usually expressed as the ratio of the width of the flood-prone area to the bankfull width, in which higher entrenchment ratios indicate higher floodplain connectivity. May be impacted by both human and natural causes.

Expert Panel – scientific panels formed by Bonneville Power Administration and the Bureau of Reclamation to assist prioritizing limiting factors, establishing habitat baselines, and habitat improvement goals directed toward meeting the objectives of the FCRPS BiOP implementation strategy.

FCRPS BiOP – Federal Columbia River Power System Biological Opinion.

FLIR – forward looking infrared sensing to determine stream temperature distribution along a stream corridor at a single point in time.

Flood Refugia – areas of lower water velocity during higher discharges. Also referred to as high-flow refugia.

Floodplain – the areas of land adjacent to a river extending out to the enclosing valley walls that are inundated with water during flood events. Soils within the floodplain are largely made up of alluvium from river deposits.

Floodplain Connectivity – a general description of the degree of interaction river flows have with the floodplain at a range of flows.

Focal Fish Species – fish species that are identified as at risk based on ESA criteria, or deemed to be culturally significant, and toward which restoration and enhancement actions are directed. For the Lochsa Atlas, they include Snake River spring Chinook salmon, Snake River summer steelhead, Columbia River bull trout, and Pacific Lamprey.

Geomorphic Potential – a ranking value assigned by assessing existing data layers and evaluating the degree to which channel process and form in a reach are functioning or could be improved to support in-channel, off-channel, and floodplain habitats.

Geomorphology – the study of the physical features of the surface of the earth and their relation to its geological structures.

Incised River – a river that cuts its channel through the bed of the valley floor, as opposed to one flowing on a floodplain. Formed by the process of degradation and sometimes expressed as the ratio of the stream's low bank height to bankfull height.

Limiting Factors – physical, biological, or chemical features experienced by fish that result in reductions in viable salmonid population parameters (abundance, productivity, spatial structure, and diversity).

Meander Belt Width – the width between points of inflection defining the lateral extents of opposing meanders over which the stream naturally moves over time. This width does not necessarily correspond with the width of the valley.

Off-Channel Habitat – habitat that is not part of the active channel, but has a direct connection to it.

Point of Diversion – the location at which surface water is diverted from a source as specified in a legal water right.

P-score – a cumulative score assigned within a biologically significant reach based on the number of life stages present for each of the four focal fish species as identified in the periodicity (thus "P" – score) tables.

Pool Frequency – a measure of the pool-to-pool spacing in a river channel.

Rearing – refers to the period of time and/or locations (rearing habitat) that juvenile fish spend feeding in nursery areas of rivers, lakes, streams and estuaries before migration.

Restoration – renewing or repairing of a natural system so that its functions and qualities are comparable to its original, unaltered state.

Riparian Zone – a riparian zone (or riparian area) is the interface between upland lands and a river or stream.

River Miles – number of miles from the mouth of a river to a specific destination.

Streambank – the terrain alongside the bed of a river that comprises the sides of the channel.

Subbasin – a structural geologic feature where a basin forms within a larger basin. Described by the USGS as a 4th level, 8-digit hydrologic unit code.

Total Maximum Daily Load (TMDL) – a calculation of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards, and an allocation of that load among the various sources of that pollutant.

Turbidity – a measure of water clarity or how much the material suspended in water decreases the passage of light through the water.

U-score – a cumulative score assigned within a biologically significant reach based on fish life stage utilization (thus "U" – score) rankings.

Watershed – an area or ridge of land that separates waters flowing to different rivers or larger subbasins. Described by the USGS as a 5th level, 10-digit hydrologic unit code.

ACRONYMS AND ABBREVIATIONS

BPA	Bonneville Power Administration
BSR	biologically significant reach
EP	Expert Panel
ESA	Endangered Species Act
FLIR	forward-looking infrared
GIS	Geographic Information System
IDEQ	Idaho Department of Environmental Quality
IDFG	Idaho Department of Fish and Game
ISRP	Independent Scientific Review Panel
Lochsa Atlas	Lochsa Atlas Restoration Prioritization Framework
NPT	Nez Perce Tribe
NOAA	National Oceanic and Atmospheric Administration
P	(Fish) Periodicity
TBD	To Be Determined
U	(Fish) Use
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service

Section 1 INTRODUCTION

During recent Independent Scientific Review Panel (ISRP) evaluations of habitat projects funded by the Bonneville Power Administration (BPA), considerable emphasis has been placed on developing a strategic framework to ensure that funding entities direct efforts toward the most important restoration priorities; restoration projects should be conducted in the right locations and in the right order based on a process-based, landscape approach (ISRP 2013, BPA 2015 and 2017). Restoration practitioners have often not considered, or did not have adequate information available to make determinations of, how and where priority work should occur, particularly at the watershed level or finer geographic scales. More recently, however, research, monitoring, and evaluation practitioners have gathered new data that are more closely linked to habitat requirements of focal fish species and are able to draw conclusions from those data, and new planning documents have been published in many subbasins throughout the Columbia River Basin. There have also been considerable gains in knowledge and experience of stream restoration techniques and the ability to apply correct treatments to address limiting factors.

Within the Lochsa River Watershed, BPA, in cooperation with restoration partners, coordinated efforts to leverage existing and new biological and physical habitat information for the development of a strategic, prioritized restoration implementation framework: the Lochsa Atlas Restoration Prioritization Framework (Lochsa Atlas). The Lochsa River Watershed was selected as a focus area among the larger Clearwater River major population groups because of an estimated potential 16 percent total improvement in habitat quality for Snake River summer steelhead (NOAA 2008). Because restoration actions have been implemented in the Lochsa River Watershed for the past 20 years, the local partners wanted to determine which areas were still a priority and what types of restoration actions should be implemented in those areas. Lochsa Atlas development began in August of 2015 with an Atlas Development Team and smaller subgroups comprising local biologists and outside the basin experts with knowledge and familiarity of focal species' life history, production, abundance, distribution, and habitat conditions within the watershed.

The intent of the Lochsa Atlas development was not to replicate previous planning efforts such as the Clearwater Subbasin Management Plan (NPCC 2003), the Clearwater National Forest Watershed Condition Framework (USDA 2011), and other salmon, steelhead and bull trout recovery plans (NMFS 2013; USFWS 2014). The Lochsa Atlas instead aimed to synthesize critical information (e.g., limiting factors, life history, habitat conditions, restoration action categories) from these previous planning efforts, while incorporating new data to strategically identify and prioritize locations and restoration actions required to enhance aquatic habitat and increase the productivity, abundance, and distribution of focal fish species that include spring/summer Chinook salmon (*Oncorhynchus tshawytscha*), summer steelhead (*O. mykiss*), bull trout (*Salvelinus confluentus*), and Pacific lamprey(*Entosphenus tridentatus*). The products of the Atlas are intended to assist restoration practitioners in:

- Integrating past and best available current data to assist in prioritizing the appropriate types of restoration actions in strategically defined locations to address key limiting factors;

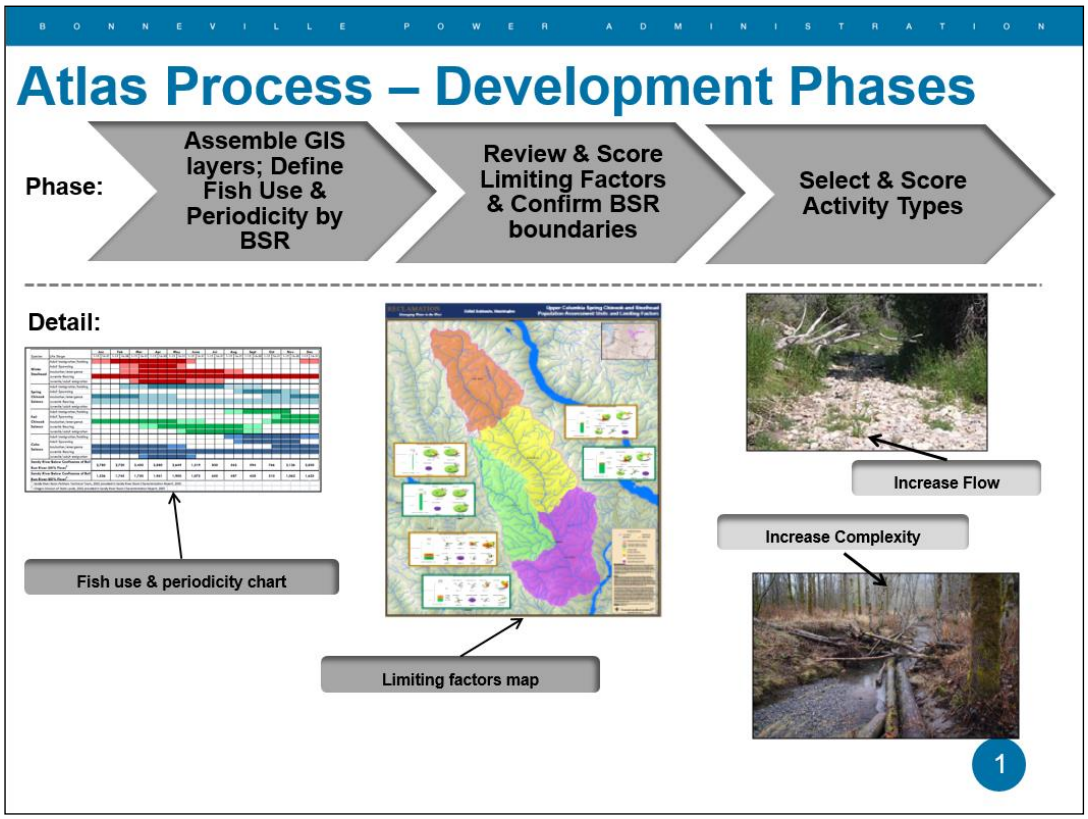
- Transitioning from the past model of opportunistic restoration and enhancement to a more accountable approach of focused restoration within key areas containing habitat for focal fish species; and
- Facilitating implementation of collaborative, focused, and biologically beneficial restoration projects.

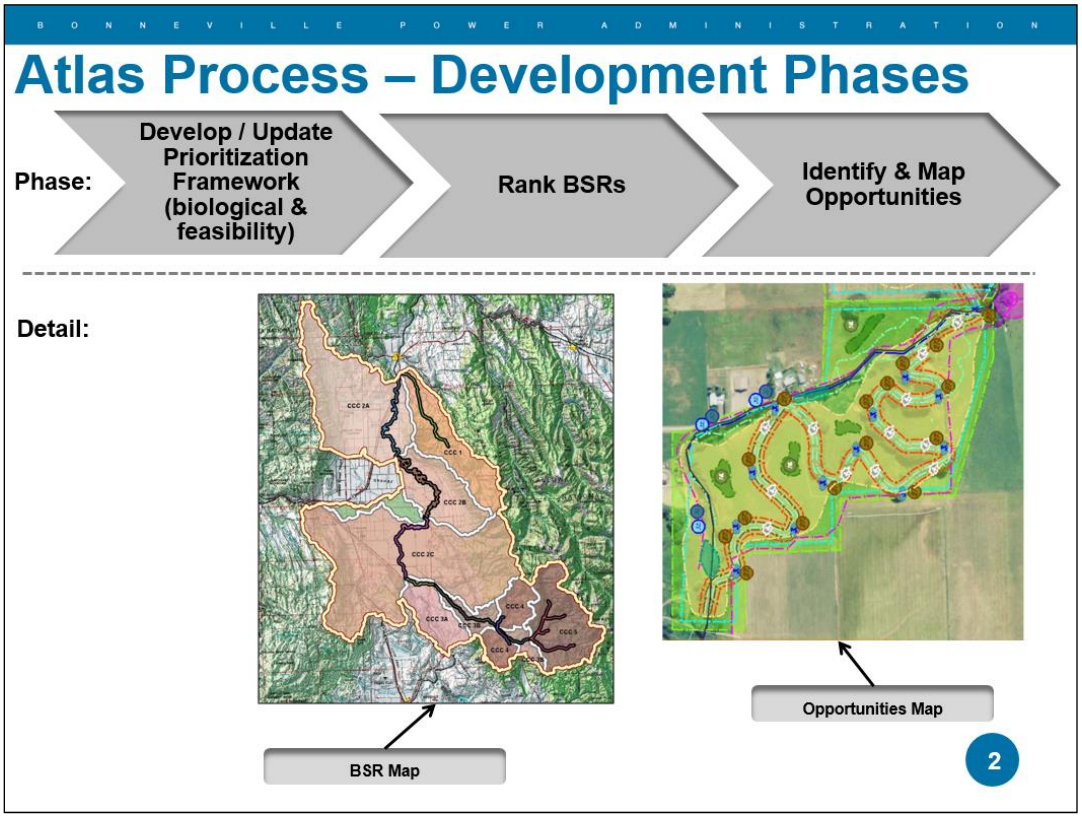
Products of the Lochsa Atlas include a centralized data and map repository with information related to focal fish species limiting factors, life history requirements, biologically significant reaches (BSRs), and habitat restoration opportunities. The Lochsa Atlas provides a scoring and ranking matrix of project opportunities and associated site maps that were collectively evaluated by local and regional partners who participated on teams throughout its development. The Lochsa Atlas development process ensures implementation of high priority, strategic habitat restoration projects that produce measurable results; maintenance of a living and collaborative prioritization framework that demonstrates objectivity, transparency, and accountability; and adaptive management of the prioritization framework and associated project implementation to ensure maximum biological benefit now and into the future.

The focus of this Lochsa Atlas summary report and user's manual is to document the technical aspects of how project areas and restoration actions were identified and evaluated. Figure 1 illustrates the development phases, depicting how existing and new information was gathered and synthesized into a user-friendly Geographic Information System (GIS) format; how fish use and periodicity were identified; how BSRs were determined based on focal fish species utilization and timing; how limiting factors were determined and their relative importance within each BSR; how restoration actions were defined, selected, and scored based on physical and biological needs; and how project restoration opportunities were identified, mapped (i.e., a "roadmap" of restoration opportunities or "Atlas"), and scored based on biological criteria. Methods for addressing how project feasibility is considered in the overall ranking strategy are also described.

The Lochsa Atlas should be considered an iterative and adaptive framework that can be adjusted as new empirical data, research evidence, and local knowledge become available. The Atlas Development Team who participated in the Lochsa Atlas throughout its development acknowledges that project opportunity scores are used to identify potential suites of restoration actions at each specific location, and watershed managers and project implementers should recognize that restoration actions identified for each project do not always translate into final project actions. The *Atlas Implementation Guidelines - Catherine Creek and Upper Grande Ronde River* (BPA 2015) provides additional documentation on the overall history and framework of how prior Atlas's were developed. It described the roles and responsibilities of the Atlas Development Team and other partners within the watershed, and provided guidance on how project opportunities are to be funded and implemented; the Lochsa Atlas will follow a similar framework. The following sections describe the development of Lochsa Atlas tools, the use of project prioritization and project opportunity matrices, followed by a summary of Lochsa Atlas development, implementation, and adaptive management now and into the future.

Figure 1. Development Phases of Lochsa Atlas Restoration Prioritization Framework





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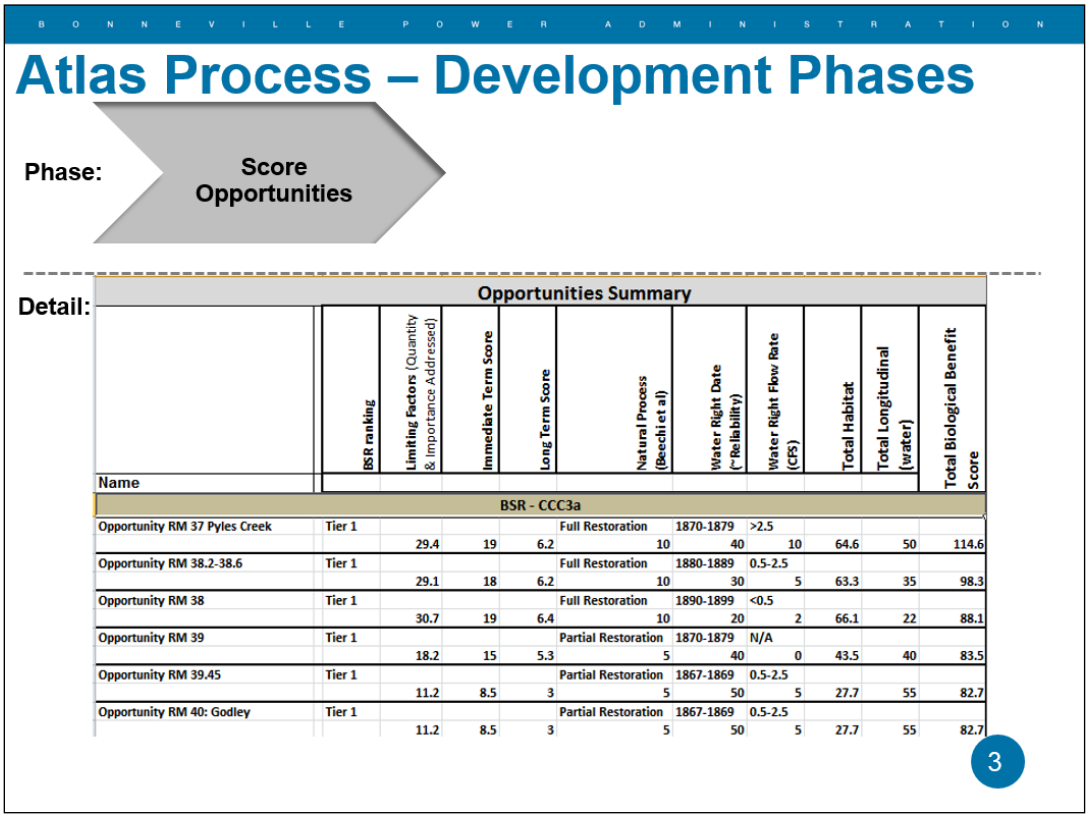


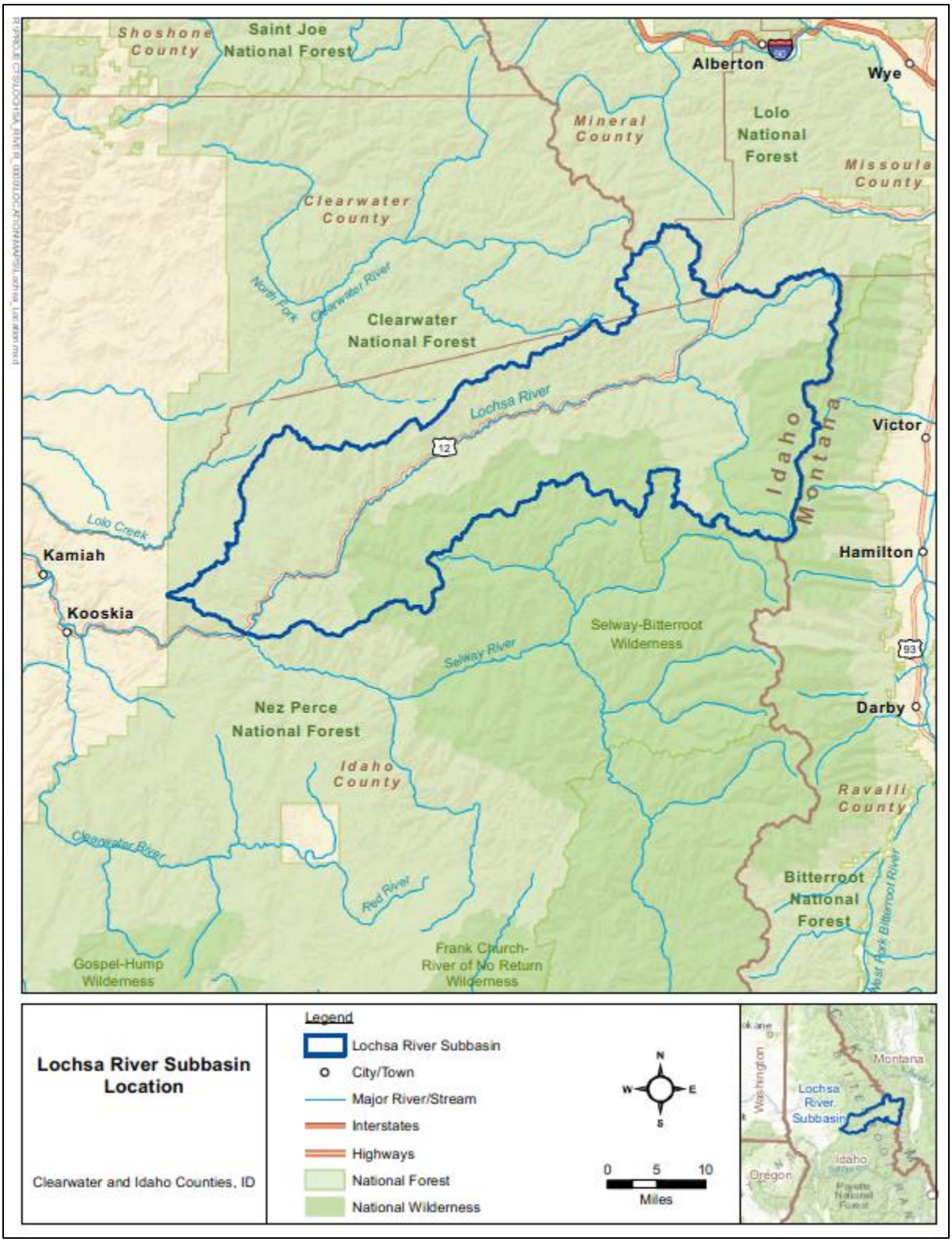
Section II LOCHSA WATERSHED DESCRIPTION

The Lochsa River Watershed is located in northeast Idaho (Figure 2). The Lochsa River is the major tributary in the watershed. Its headwaters originate in the Bitterroot Mountains along the Idaho/Montana border, and the stream flows southwesterly to its confluence with the Clearwater River, about 22 miles east of Kooskia, Idaho. The watershed encompasses a drainage area of 1,182 square miles, with an elevation range of 8,680 feet at its headwaters to 1,450 feet at its confluence with the Clearwater River. Landownership largely consists of portions of the Nez Perce – Clearwater National Forest and wilderness, with checkerboard private timbered holdings in the Crooked Creek and Brushy Creek drainages. Road densities are moderate to high, ranging from 3 to greater than 7.5 miles per square mile. Topography is dominated by mountainous terrain and breaklands, with side slopes exceeding 60 percent (NPCC 2003). Average annual precipitation is more than 50 inches, and winter precipitation is mainly snow, with rain more common at lower elevations.

The Lochsa River Watershed contains critical habitat for Endangered Species Act (ESA)-listed Snake River summer steelhead and Columbia River bull trout. Indigenous spring Chinook salmon are not ESA-listed since they were eliminated by the Lewiston Dam (constructed in 1927 and later removed in 1973), but naturalized populations have since been reestablished and are supplemented with hatchery stocks (NPCC 2003). Management of anadromous species mostly focuses on maintaining naturally producing wild stocks. All three of these species within Lochsa River subwatersheds are mostly classified as "present-depressed" (NPCC 2003). Pacific lamprey are present in the lower portions of the mainstem Lochsa River, but information on life history is limited. Lamprey are not federally listed, but are listed as endangered by IDFG (2011), and are of key conservation interest as species of cultural importance to the Nez Perce Tribe (NPT). Other native species include a strong population of Westslope cutthroat trout (*O. clarki lewisi*), mountain whitefish (*Prosopium williamsoni*), and several non-game fish species including sculpins, suckers, and dace.

Major factors limiting fish populations in the Lochsa River Watershed include sedimentation, lack of instream cover including large wood and high quality pools, and upland impacts from road construction and timber harvest. Competition or hybridization with brook trout (*Salvelinus fontinalis*) is also a concern. High stream temperatures are a concern mostly in the lower mainstem Lochsa River (NPCC 2003).

Figure 2. Lochsa River Watershed in Idaho



Section III ATLAS TOOL DEVELOPMENT

Lochsa Atlas tools included assembly of all of the best available and current data into a transparent and user-friendly GIS and web-based ArcGIS Online format, incorporating data into prioritization matrices, and mapping of restoration opportunities. These tools were developed by an Atlas Development Team and smaller subgroups comprising local biologists and outside the basin experts with knowledge and familiarity of focal fish species life history, production, abundance and distribution, and habitat conditions within the watershed. The Atlas Development Team was primarily composed of fisheries, habitat restoration, and research biologists. The Atlas Development Team performed the initial evaluation of spatial data layers and best available current data to interpret how fish are using specific areas of the watershed, the life stage(s) in each area that is currently limiting the population, identified the primary limiting habitat factors by area, and recommended restoration actions that have the greatest ability to address the limiting habitat factors and benefit the limiting life stages. Products from the Atlas Development Team include the prioritization of areas, actions, and associated rankings as summarized below.

III.1 INFORMATION USED

A critical first step in the Lochsa Atlas was to assemble all of the best available and current data into a transparent and user-friendly format to determine where, when, and how focal fish species use different areas of the Lochsa River and its tributaries. Existing planning documents, results of research and monitoring, pertinent scientific literature, and new or unpublished data provided by researchers were used to identify specific criteria for the preferred biological and physical habitat of the focal species. Data and information were presented in a spatial context through ArcGIS Online and on a Lochsa Atlas Development Map website, and used by the Atlas Development Team to evaluate fish utilization of habitat, timing (periodicity) and life stage use, limiting factors affecting each focal species, , and in delineating watershed area subdivisions (i.e., defining BSRs).

In addition to general planning and cadastral layers, such as public land survey system, tax lots, county boundaries, aerial background imagery, topography, roads, and other administrative boundaries, GIS data gathering focused on biological, ecological, and physical data pertinent to habitat prioritization, such as:

- **Hydrography-Hydrology –** flood inundation zones, bathymetry data, surface water framework, and stream layers.
- **Water Quality and Quantity –** Total Maximum Daily Load 303d listings, point sources of pollutants, existing stream temperature data (thermographs and forward-looking infrared sensing [FLIR]) and predicted temperature data based on modeling, and stream gage stations.
- **Fisheries and Fish Habitat –** Idaho Department of Fish and Game (IDFG), U.S. Forest Service (USFS), Idaho Department of Environmental Quality (IDEQ), and NPT aquatic habitat inventories, fish life history (smolt outmigrant screw traps, radio telemetry, and redd count data), Ecosystem Diagnosis and Treatment reaches, fish passage barriers, hatchery facilities, StreamNet layers for focal species utilization for spawning, rearing, and migration

areas, and National Oceanic and Atmospheric Administration (NOAA) and United States Fish and Wildlife Service (USFWS) critical habitat designations.

Presenting geospatial fisheries information to the Atlas Development Team allowed for a transparent and accountable decision making framework. During analysis of the GIS data, various delineations of watershed areas and existing assessment units were reviewed. The GIS platform enabled the Atlas Development Team to display and analyze available data in a spatial context for the assessment of fish utilization at various scales as identified in the following section. During these procedures, the Atlas Development Team also identified important data gaps.

III.2 Fish Periodicity and Life Stage Use

Fish use and periodicity were determined for each of the focal species (spring Chinook salmon, steelhead, bull trout, and lamprey), at several life stages depending on species, including adult immigration, adult holding, spawning, incubation/emergence, juvenile summer rearing, juvenile winter rearing, juvenile emigration, and adult emigration. From these data, fish periodicity tables were developed within the Lochsa Prioritization Matrix spreadsheet, with a Periodicity worksheet to represent each area of the watershed. An example of a fish periodicity table is shown in Figure 3, with darker shades of colors representing high certainty that a fish species and life stage is present, and lighter shades of colors indicating relatively less certainty of fish species or life stage presence. Figure 3 also illustrates that, for each species and life stage, a drop-down menu was used to indicate the source of the information (data, opinion, or not applicable), and a comments column was used to document data sources or best professional judgment.

Within the Lochsa Prioritization Matrix spreadsheet, information on fish life stage utilization was also recorded within a Restoration Action Prioritization worksheet. Fish life stage utilization was summarized for each of the watershed areas and assigned qualitative ratings of High, Medium, or Low based on overall analysis by the Atlas Development Team, as illustrated in Figure 4 below. Scores were defined based on knowledge of *current fish use* as follows:

- High (H) – High priority life stage use in need of *short term action (1-5 years,)* to improve population productivity, abundance, and distribution.
- Medium (M) – Medium priority life stage in need of *medium term action (5-10 years,)* to improve population productivity, abundance, and distribution.
- Low (L) – Low priority life stage in need of *long term action (10-20 years,)* to improve population productivity, abundance, and distribution.
- N/A – Life stage is not present.

Comments were recorded in the worksheets to provide supporting documentation and it was also noted if ratings needed to be revisited in the future if data were weak or absent. The number of fish life stages present and fish use scores would later factor into the ranking of BSRs. Periodicity tables were then used to guide discussions of appropriate biological watershed areas and refine limiting factors, if necessary, as described in the following two sections.

Figure 3. Example Fish Periodicity Table

Lochsa River Fish Periodicity: Assessment Unit LAS-6 (main stem Lochsa)

Species	Life Stage	Jan		Feb		Mar		Apr		May		June		Jul		Aug		Sept		Oct		Nov		Dec		Source	Comments
		1-15	16-31	1-15	16-28	1-15	16-31	1-15	16-30	1-15	16-31	1-15	16-31	1-15	16-31	1-15	16-31	1-15	16-30	1-15	16-31	1-15	16-30	1-15	16-31		
Steelhead	Adult Immigration																									Data	
	Adult Holding																									Data	Prelim telemetry data suggest winter holding in main Clearwater
	Spawning																									Opinion	Magnitude of mainstem spawning hard to assess. Most thought to be in tribs.
	Incubation/Emergence																									Opinion	Magnitude of mainstem spawning hard to assess
	Summer Rearing																									Data	Screw trap data, IDFG reports
	Winter Rearing																									Data	Screw trap data, IDFG reports
	Juvenile Emigration																									Data	Screw trap data, IDFG reports
	Adult Emigration																									Data	Weir on Fish Creek, IDFG reports
Chinook Salmon	Adult Immigration																									Opinion	
	Adult Holding																									Opinion	
	Spawning																									Data	Infrequent spawning in the Powell area; starting in 2001, observation of adults spawning entire system (specifically last 2 miles downstream of Badger Creek & upstream of Split Creek)
	Incubation/Emergence																									Data	Infrequent spawning in the Powell area
	Summer Rearing																									Data	Screw trap data & snorkel surveys, IDFG reports
	Winter Rearing																									Data	Screw trap data, IDFG reports
	Juvenile Emigration (Age 0)																									Data	Screw trap data, IDFG reports
	Juvenile Emigration (Age 1)																									Data	Screw trap data, IDFG reports
Bull trout (Fluvial)	Adult Immigration																									Data	Telemetry study 2003-2005, IDFG reports
	Adult Holding																									Data	Telemetry study 2003-2005, IDFG reports
	Spawning																									Opinion	Unlikely
	Incubation/Emergence																									Opinion	Unlikely
	Summer Rearing																									Opinion	Juvenile/subadult use limited
	Winter Rearing																									Opinion	Juvenile/subadult use limited
	Juvenile Emigration																									Opinion	NA
Lamprey	Adult Immigration																									Data	McIlraith etal 2015 telemetry study 2006, 2007, 2008
	Adult Holding																									NA	
	Spawning																									Opinion	Spawning not documented, but ammocetes observed during summer electroshocking surveys
	Ammocoete Incubation/Emergence																									NA	un-necessary ammocoete, covered by rearing
	Summer Rearing																									Data	Cochanaier and Claire 2009, Peery pers. com. Elecrtoshocking surveys
	Winter Rearing																									Opinion	Inferred from available data and knowledge of life history
	Juvenile Emigration																									Data	IDFG screw trap data; peak emigration timing is based on opinion
	Adult Emigration																									NA	

The light shaded cells represent the time periods during which there is relatively less certainty that a fish species and life stage is present.

Figure 4. Example Fish Utilization and Life Stage Ratings Summary

Fish Use & Life Stage Utilization: LAS 6 (mainstem Lochsa River)									
	Priorities				Source				
Fish Utilization	Steelhead	Chinook	Bull Trout	Lamprey	Steelhead	Chinook	Bull Trout	Lamprey	Comments
Adult Immigration	L	L	L	L	Data	Data	Data	Data	Snorkel and habitat surveys USFS; new data soon available from IDFG; re-visit after analyzing limiting factors; lamprey data source: McIlraith etal 2015 telemetry study 2006, 2007, 2008.
Adult Holding	N/A	L	L	N/A	Data	Data	Data	N/A	Snorkel and habitat surveys USFS.
Spawning	L	L	L	M	Data	Data	Data	Opinion	Snorkel and habitat surveys USFS; lamprey data source: McIlraith etal 2015 telemetry study 2006, 2007, 2008.
Incubation / Emergence	L	L	L	N/A	Data	Data	Data	N/A	Snorkel and habitat surveys USFS.
Summer Rearing	L	L	L	M	Data	Data	Data	Data	Snorkel and habitat surveys USFS; lamprey data source: McIlraith etal 2015 telemetry study 2006, 2007, 2008.
Winter Rearing	M	M	M	M	Data	Data	Data	Opinion	Snorkel and habitat surveys USFS; focus on side channels & water floodplain areas (certain sections w/in BSR); lamprey data source: McIlraith etal 2015 telemetry study 2006, 2007, 2008.
Juvenile Emigration	L	L	L	L	Data	Data	Data	Opinion	Snorkel and habitat surveys USFS; lamprey data source: McIlraith etal 2015 telemetry study 2006, 2007, 2008.
Adult Emigration	L	N/A	L	N/A	Data	Data	Data	N/A	Snorkel and habitat surveys USFS.

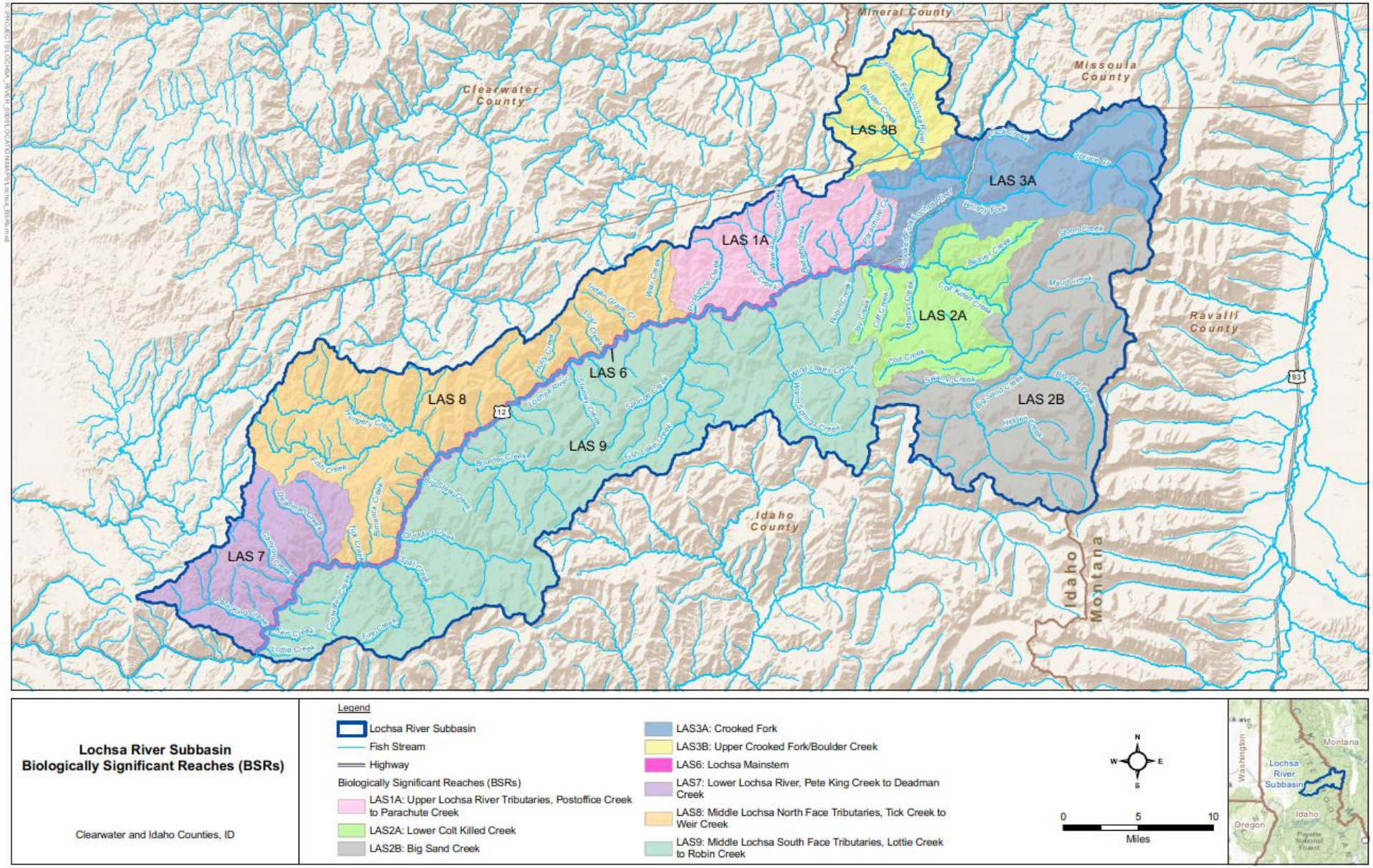
III.3 BIOLOGICALLY SIGNIFICANT REACH DELINEATION

Using the fish periodicity and fish life stage utilization tables along with GIS-referenced biological data, the existing watershed areas from previous planning documents were refined into BSRs that were defined as areas with similar fish use and limiting habitat factors. These reaches represent the "fish's view of the river." For example, a section of river that is used for spawning and incubation requires specific functional physical and biological parameters (e.g., flow, temperature, and specific substrate size and type). If these conditions are not present, fish species presence or survival will be limited. Another reach of the river system may be identified as primarily juvenile summer rearing habitat, resulting in a different set of parameters necessary for survival. Therefore, depending on location, geomorphology, and species use, each BSR may have a different suite of appropriate restoration actions.

For the Lochsa River Watershed, initial BSR geographic area determinations were based on the nine Expert Panel (EP) summer steelhead assessment unit designations (USBR 2012). Following detailed evaluation of fish use and timing in those assessment areas, the Atlas Development Team agreed to use these same geographic areas for designating BSRs. The final BSR delineations used throughout the development of the Lochsa Atlas are illustrated in Figure 5.

It was important to correctly delineate BSRs because they represent the first level of hierarchy in the overall rating and ranking system (i.e., they determine the broader geographic areas where restoration work should be sequenced over time). Ranking BSRs relative to one another occurred at a later development phase, after refining and scoring limiting habitat factors, and after identifying restoration actions as described in the next two sections.

Figure 5. Final BSR Delineations for the Lochsa River Watershed



III.4 Refine and Score Limiting Habitat Factors

Once the BSRs were identified and mapped, additional biological data were used to refine limiting habitat factors that had been previously identified within higher level planning documents (such as subbasin plans, recovery plans, and EP workshops). Temperature, flow, fish distribution, habitat surveys, and other data sets were presented as GIS layers relative to existing BSRs to update or confirm previously determined limiting habitat factors at a finer resolution. NOAA (2012) standardized limiting factors for summer steelhead, as identified and weighted during the EP workshops (USBR 2012), were used as the initial basis of comparison; however, in most cases the Atlas Development Team added limiting factors to the list for each BSR based on local knowledge.

Based on knowledge of current fish use, empirical data, published research evidence, or local knowledge, ratings of High, Medium, or Low were assigned to each limiting habitat factor, as defined below:

- High (H) – High priority factors that need to be addressed in the *short term (1-5 years)*, to improve population productivity, abundance, and distribution.
- Medium (M) – Medium priority factors that need to be addressed in the *medium term (5-10 years)*, to improve population productivity, abundance, and distribution.
- Low (L) – Low priority factors that need to be addressed in the *long term (10-20 years)*, to improve population productivity, abundance, and distribution.

The source of information for each High, Medium, or Low rating was selected from a drop-down menu and listed as data, opinion, or N/A. Comments specific to the BSR were added into each respective Restoration Action Prioritization Worksheet to document data sources, reasons for the assigned ratings, data gaps, or note limiting habitat factors that were added by the Atlas Development Team, as illustrated in Figure 6 below.

Figure 6. Example of Limiting Habitat Factor Ratings for the Lochsa River

Limiting Factors: LAS6				
Limiting Factor ID	**Description**	**Priority**	**Source**	**Comments**
3.1	Altered Primary Productivity	H	Opinion	Based on historic accounts of spawning, intrinsic potential
8.1	Temperature	H	Data	Forest Service temperature data, thermographs; USGS temperature gauge at Loscha mouth (daytime high extreme is 25 degrees C)
2.1	Predation	L	Data	Smallmouth Bass Low density in lower drainage
5.1	Side Channel and Wetland Conditions	M	Data	Isolated in small areas where Hwy 12 has cut off meanders; 1.3 miles of meanders disconnected due to HWY 12 (2%?)
8.7	Toxic Contaminants	L	Opinion	How do spills from the highway factor into this? No existing, not consistent; low probability but high consequences
1.1	Anthropogenic Barriers	M	Opinion	**added - restoration action # 22 addresses these factors**
10.2	Small Population Effects	M	Opinion	**added - restoration action # 22 addresses these factors**
7.2	Increased Sediment Quantity	M	Opinion	**added - restoration action # 34 addresses these factors**
8.4	Turbidity	M	Opinion	**added - restoration action # 34addresses these factors**
3.3	Altered Prey Species Composition and Diversi	M	Opinion	**added - restoration action # 28 addresses these factors**
4.1	Riparian Vegetation	M	Opinion	**added - restoration action # 28 addresses these factors**
5.2	Floodplain Condition	M	Opinion	**added - restoration action # 28 addresses these factors**
6.1	Bed and Channel Form	M	Opinion	**added - restoration action # 28 addresses these factors**
6.2	Instream Structural Complexity	M	Opinion	**added - restoration action # 28 addresses these factors**
Source (Limiting Factors data): Expert Panel [X] Sub-Basin [ ] Recovery Plan [ ]				

The limiting factor ratings were later assigned scores that would factor into the ranking of project opportunities as described in Section II.8. The results of these exercises were also recorded and documented in the same Restoration Action Prioritization Worksheet where fish periodicity and fish life stage utilization data were stored, and the combined results were used to inform restoration action decisions as described in the following section.

III.5 Rating of Restoration Actions

Restoration actions appropriate for a given BSR were identified and rated within the Restoration Action Prioritization Worksheet, in a separate Restoration Actions table. The purpose of the Restoration Actions table was to ensure that proposed restoration actions align with current fish use and critical limiting habitat factors based on the best available and most current data; therefore, restoration actions for each BSR were assigned while reviewing the fish life stage utilization scores (see Section II.2 and Figures 3 and 4 above), in combination with the limiting habitat factor scores (Section II.4 and Figure 6). Restoration actions were grouped into 10 broader categories (e.g., channel modification, floodplain reconnection), and a total of 36 individual actions were assigned action numbers (1-36) within those categories. The restoration actions were intended to provide a comprehensive list of all potential actions that could be implemented; therefore, they include a full suite of passive to active restoration and protection approaches, and include actions that are very site-specific, to those covering larger, watershed-scale actions. An example of a completed Restoration Actions table is illustrated in Figure 7. Based on knowledge of *current fish use*, and considering the actions that would best address limiting habitat factors and benefit critical life stages, each restoration action was assigned a qualitative rating as follows:

- High (H) – High priority action that should be implemented in the *short term (1-5 years)*, to improve population productivity, abundance, and distribution.
- Medium (M) – Medium priority action that should be implemented in the *medium term (5-10 years)*, to improve population productivity, abundance, and distribution.
- Low (L) – Low priority action that should be implemented in the *long term (10-20 years)*, to improve population productivity, abundance, and distribution.
- N/A – Action that would not provide immediate or future benefits.

Comments specific to the BSR were added to the spreadsheet data to document the rationale behind the ratings, as illustrated in Figure 7 below. The restoration action ratings would factor into the ranking of potential project opportunities as described in Section II.8. Explanations of some of the restoration actions that may not be readily understood are provided in Appendix A.

Figure 7. Example Restoration Actions Worksheet

Restoration Actions: LAS 6				
Description by Group & Action			Priority	Comments
Dedicating Land and Water to the Preservation and Restoration of Stream Habitat				
	1	Protect Land and Water (Easement, Acquisition)	N/A	Public land
Channel Modification				
	2	Channel Reconstruction	N/A	n/a
	3	Pool Development	N/A	n/a
	4	Riffle Construction	N/A	n/a
	5	Meander (Oxbow) Re-connect - Reconstruction	M	Hwy 12 Meander cutoffs; major fenn
	6	Spawning Gravel Cleaning and Placement	N/A	n/a
Floodplain Reconnection				
	7	Levee Modification: Removal, Setback, Breach	N/A	No levees
	8	Remove - Relocate Floodplain Infrastructure	N/A	n/a
	9	Restoration of Floodplain Topography and Vegetation	N/A	n/a
	10	Floodplain Construction	N/A	n/a
Side Channel / Off-Channel Habitat Restoration				
	11	Perennial Side Channel	L	Changed from N/A to L; major fenn
	12	Secondary (non-perrenial) Channel	N/A	n/a
	13	Floodplain Pond - Wetland	N/A	n/a
	14	Alcove	N/A	n/a
	15	Hyporheic Off-Channel Habitat (Groundwater)	N/A	n/a
	16	Beaver Restoration Management	N/A	n/a
Riparian Restoration & Management				
	17	Riparian Fencing	N/A	n/a
	18	Riparian Buffer Strip, Planting	H	Necessary in many areas of the BSR
	19	Thinning or removal of understory	N/A	n/a
	20	Remove non-native plants	L	Implications to fish low based on disturbance of hwy corridor; changed from H to L; linked to ground disturbing actions
Fish Passage Restoration				
	21	Dam removal or breaching	N/A	No dams
	22	Barrier or culvert replacement/removal	L	Few barriers in mainstem Lochsa BSR that would affect population performance
	23	Structural Passage (Diversions)	N/A	No diversions
Nutrient Supplementation				
	24	Addition of organic and inorganic nutrients	H	Based on LF 3.1
Instream Structures, LWD/Logjams				
	25	Rock Weirs	N/A	Enough boulders in river
	26	Boulder Placement	N/A	
	27	LWD Placement	N/A	
Bank Restoration, Modification, Removal				
	28	Modification or Removal of Bank Armoring	L	Changed from N/A to L; some opportunities on HWY to adjust rip-rap area
	29	Restore banklines with LWD - Bioengineering	N/A	
Water Quality - Quatitiy Impacts				
	30	Aquire Instream Flow (Lease- Purchase)	N/A	
	31	Improve Thermal Refugia (spring reconnect, other)	N/A	
	32	Irrigation System Upgrades -Water Management	N/A	
	33	Reduce - Mitigate Point Source Impacts	L	Potential for spills as well as brake contaminents; changed from n/a to L
	34	Upland Vegetation Treatment - Management	L	Changed to L based on upland planting needs in certain areas only
	35	Road Decomissionsing or abandonment	N/A	
	36	Road Grading - Drainage Improvments	M	Ditches of HWY

III.6 BSR PRIORITIZATION MATRIX

The BSR matrix was a separate worksheet within the Lochsa Prioritization Matrix spreadsheet. It was developed to rank geographic areas where restoration work most beneficial to salmonid population performance should occur. It consisted of a separate scoring system used to rank the nine Lochsa Watershed BSRs relative to each other. The purpose of ranking BSRs was to ensure that restoration efforts are sequenced over time, in which Tier I areas are the highest priority, followed by Tier II and Tier III.

The framework for prioritizing BSRs was founded on recent and relevant literature related to fisheries restoration priorities (Roni et al. 2002; Beechie et al. 2008), and based on the following principles:

1. Build from existing production areas.
2. Target areas with critical species and life stages present.
3. Target areas where there is geomorphic potential to affect change (available floodplain to implement a broader range of restoration actions).
4. Target areas where the current habitat condition allows the ability to affect change (i.e., habitat condition is somewhere between completely degraded, requiring great effort for little change, and pristine conditions in which there is little room for improvement).

III.6.1 BSR Scoring Categories

A scoring system was developed to evaluate BSRs based on the four aforementioned principles. Scoring categories were classified as either providing inputs on impacts to species or inputs for the ability to affect change. The BSR prioritization matrix used information from earlier Atlas Development Team efforts in identifying fish periodicity, life stages, and critical limiting habitat factors (see Section II.2, Fish Periodicity and Life Stage Use) to evaluate the first two principles. Two separate scores (P-score and U-score) were developed as described below. To evaluate the third and fourth principles related to the ability to affect change, the Atlas Development Team evaluated additional data layers that were made available in ArcGIS Online format to rate geomorphic potential, current habitat condition, and current temperature. The rating categories and rationale are summarized as follows:

Periodicity (P)-score: Targets current production stronghold areas from which outward expansion of the focal species can occur. It is based on the raw count of the number of life stages of each focal fish species present, as determined from the periodicity tables. The length of time that a life stage is present was not factored in as an indication of importance (i.e., spawning may only occur over a few weeks, but is equally important as summer or winter rearing which occurs over months). BSRs that have multiple species and more life stages present receive the highest scores, which are based on the combined total count of those species and life stages present. The number of life stages counted from the periodicity charts was multiplied by a calibration factor to ensure that the P-score accounted for up to 25 points of the total possible score of 105.

Use (U)-score: Targets areas based on the number of critical/imperiled life stages present and their ratings (High, Medium, Low) as determined from the fish utilization scores. BSRs with the most life stages present and that received ratings of High (critical life stage use in need of *immediate* action to improve population productivity, abundance, and distribution) received the highest scores. The qualitative ratings of High, Medium, and Low were converted to numerical values (5, 3, and 1, respectively) and multiplied by a calibration factor to ensure that the U-score accounted for up to 25 points of the total possible score of 105.

Geomorphic Potential Score: Targets areas with the ability to affect change in terms of geomorphic potential, and is based on the assumption that moderately confined or unconfined reaches present more physical opportunities to implement restoration actions that can increase both habitat quantity and quality. The primary data layer used by the Atlas Development Team to evaluate geomorphic potential was:

- NOAA Science Center: Chinook intrinsic potential data layer (incorporates stream width, valley width, gradient, with a sediment filter).

Qualitative ratings of High, Medium, or Low were assigned to each BSR to reflect the amount of floodplain available for restoration actions, and were converted to numeric values (25, 15, and 5, respectively) to account for up to 25 points of the total possible score of 105.

Current Habitat Condition Score: Targets areas with the ability to affect change by enhancing habitat conditions. Scores reflect the expected improvements, and are based on the assumption that areas with fair to good habitat provide the most opportunity for improvement, while areas with poor habitat would require larger investments for minimal improvement, and areas with excellent habitat provide little opportunity for improvement beyond their current condition. The primary data layers used by the Atlas Development Team to evaluate current habitat condition were:

- IDFG, USFS, and NPT snorkel surveys and habitat data.
- IDFG redd waypoint data.
- USFWS and NOAA critical habitat.
- IDEQ stream surveys.

Qualitative ratings of Excellent, Good, Fair, and Poor were converted to numeric values (5, 25, 25, and 5, respectively) to account for up to 25 points of the total possible score of 105.

Current Temperature Score: Included as a sub-score within the Current Habitat Condition Score, and acts primarily as a filter for the ability to affect change. This category had a smaller impact on the Current Habitat Condition Score and overall BSR rankings, but was listed as a separate scoring category because if stream temperatures were poor or lethal, then existing or newly created habitat cannot be fully utilized. The primary data layers used by the Atlas Development Team to rate stream temperatures were:

- Columbia River Inter-tribal Fish Commission: Clearwater Basin temperature model.
- NorWest stream temperatures.
- IDEQ temperature data.

Qualitative ratings of Excellent, Good, Fair, and Poor were converted to numeric values (5, 3, 0, and -5, respectively) to account for up to 5 points of the total possible Current Habitat Condition score of 30.

III.6.2 BSR Output

The Atlas Development Team reviewed the appropriate GIS data and completed the "Inputs for Ability to Affect Change" columns by selecting qualitative ratings for the Geomorphic Potential, Current Habitat Condition, and Current Temperature variables (Figure 8, steps 1-3). In the "Ability to Affect Change Scoring" columns, all qualitative ratings were automatically converted to numeric values based on the conversion values noted above. The previously determined qualitative P- and U-ratings completed within the Restoration Action Prioritization worksheet were linked to the BSR matrix worksheet, automatically converted to numeric scores, and self-populated the Species Impact Scoring columns (Figure 8, step 4). The resulting cumulative scores were calculated for each BSR.

The total scores were used by the Atlas Development Team to rank BSRs into three major categories as illustrated in Figure 8 (step 5), and as defined below:

- **Tier I** – High priority areas for restoration; actions within these BSRs should be the first to implement within the sequence barring any feasibility constraints.
- **Tier II** – Medium priority areas; actions within these BSRs should implemented when the Tier I actions are either complete or not available due to feasibility constraints.
- **Tier III** – Low priority areas; actions should be implemented within these BSRs when Tier I or Tier II actions are either complete or not available due to feasibility constraints.

The BSR ranking into Tiers I, II, or III represented the first hierarchy in ranking project opportunities as described in the following section. Additional details on BSR matrix refinements, use, and results are described in Section IV.1.

Following completion of ratings for restoration actions within each BRS and final prioritization of BSRs was achieved, high level mapping of project opportunities was conducted, as described in the following section.

Figure 8. BSR Matrix Scoring Methods

Steps 1-3 – Review existing data and GIS layers. Click on the cell to select an option from the drop down menus.

Step 4 – Species impact scores self-populate using formulas and data linked to other worksheets.

Step 5 – Ranked BSRs by Tier I, II, III

Lochsa Biologically Significant Reach (BSR) - Ranking									
	Inputs for Ability to Affect Change			Species Impact Scoring		Ability to Affect Change Scoring		Results	
BSR	Geomorphic Potential Classification	Current Condition Classification	Current Temperature	U-Score (Critical use / bottleneck)	P-Score (Presence, Current Production Area)	Geomorphic Score (lateral confinement ratio)	Current Condition Score	Cummalative Score (Inputs converted to a number then summed)	Ranking (Tier I,II,III)
LAS-1a	Medium	Good	Good	18	25	15	28	86	Tier I
LAS-2a	Medium	Good	Good	9	25	15	28	77	Tier I
LAS-2b	Low	Excellent	Excellent	6	25	5	10	46	Tier III
LAS-3a	High	Fair	Good	18	25	25	28	96	Tier I
LAS-3b	Medium	Good	Excellent	8	16	15	30	69	Tier II
LAS-6	Low	Good	Fair	11	27	5	25	68	Tier II
LAS-7	High	Fair	Fair	15	17	25	25	82	Tier I
LAS-8	Low	Good	Excellent	6	18	5	30	59	Tier II
LAS-9	Low	Excellent	Excellent	6	17	5	10	38	Tier III

Source Information:

- Assessment utilizing GIS map layers CRITFC Valley Setting, Intrinsic Potential
- Assessment utilizing IDFG, USFS, and NPT snorkel and habitat data, use type, redd data
- Based on temperature data
- Fish use & life stage utilization table from the restoration action worksheet of the respective BSR
- Periodicity charts of the respective BSR

Self-populates – the BSR Matrix worksheet is linked to data within other worksheets and any calibration factors needed to calculate individual and cumulative scores.

III.7 HIGH-LEVEL MAPPING OF RESTORATION OPPORTUNITIES

Once fish limiting habitat factors were determined and potential restoration actions were identified based on those needs, restoration opportunity mapping began. The mapping phase used stream geomorphic data and various other GIS layers to identify restoration and protection opportunities for implementation. This mapping phase was described as "high level" because the mapped areas were generally larger than what might typically occur at the project implementation stage, and actions were identified by simple polygons and basic line work, but without construction-level details.

Restoration actions were identified by the action numbers from the Restoration Actions table for the entire BSR (see Figure 7 above), but actual locations of potential actions were mapped to a smaller potential project area level that included stream reaches, but also included adjacent upland areas when those areas included upslope actions such as road decommissioning. For example, in areas where floodplain reconnection was identified as a need, GIS terrain layers were used to determine opportunities for levee setback (Action 7) or locate where relic channels are still present and could be reactivated (Action 5). If flow or temperature was a priority, water right points of diversion were identified to locate areas where increased flow might be achieved (Action 30), or FLIR data used to identify cool water spring locations that might be reconnected (Action 31). Opportunity mapping was completed using ArcMap and ArcGIS Online software that could be reviewed by the Atlas Development Team. Once reviewed, the resulting set of maps (or "Atlas") of project opportunities were distributed to the Atlas Development Team and the Lochsa Atlas Implementation Team. An example opportunity map is illustrated in Figure 9 below, with restoration actions (in this case #27 – LWD Placement) listed in the data properties callout.

It is important to note that, during this process, opportunities and actions that were identified were based on the Atlas Development Team's opinion of all the work that *could be* accomplished to achieve full site potential, without taking into consideration landowner willingness or other related feasibility criteria. The feasibility of implementing identified actions was evaluated in a separate process. Geologic or geomorphic conditions such as channel confinement were taken into consideration. For example, restoring floodplain connectivity within a confined reach would not be feasible and not be identified as an action.

Figure 9. Example High-Level Opportunity Map

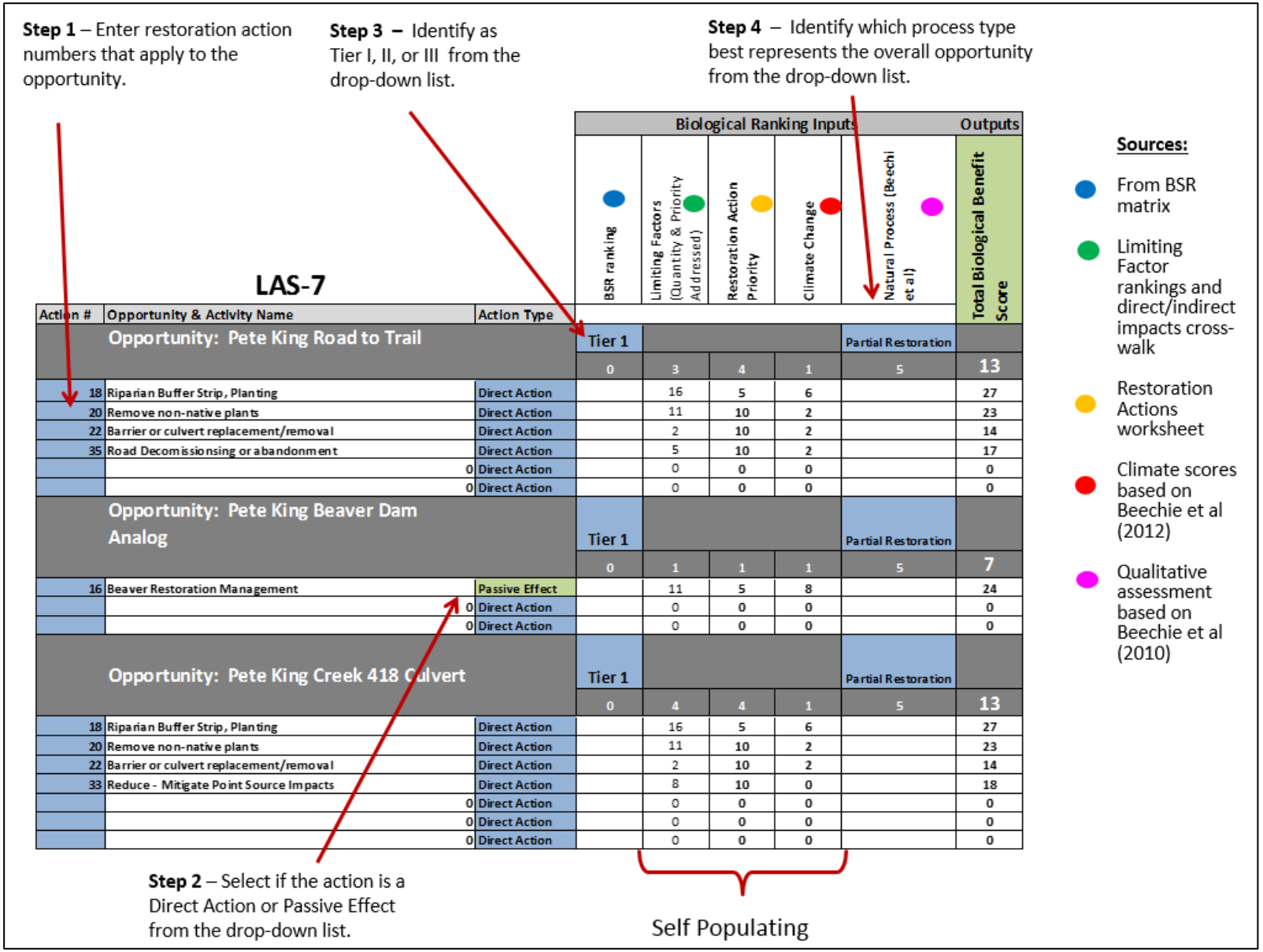
III.8 OPPORTUNITY PRIORITIZATION MATRIX

Opportunity prioritization matrices for each BSR were included as separate worksheets within the Lochsa Prioritization Matrix spreadsheet and were used to list and score project opportunities within each BSR. Project opportunities within each BSR are prioritized based on input variables that included:

1. Ranking of the BSR they are located within (Tier I, II, or III);
2. A project opportunity's ability to address the most important and the greatest number of limiting habitat factors;
3. The number and importance of restoration actions chosen for a project opportunity;
4. Determination of whether the project opportunity meets full restoration, partial restoration, or simply short-term habitat restoration based on Beechie et al. (2010);
5. Assessment of the restoration action's ability to address climate change based on Beechie et al. (2012); and
6. Presence of water rights and if the opportunity has the potential to carry longitudinal benefits (flow) into downstream reaches. (Note: this category was not used in the Lochsa River Watershed due to the absence of irrigation diversions.)

Within each BSR, project opportunities were named and described based on location and general action categories (e.g., Lolo Pass Highway Sediment Reduction). Project opportunities might occur at a spot location if the restoration actions are site specific, such as eliminating a point source of contamination, or removing or replacing a culvert. Opportunities could also be much larger if, for example, a 3-mile reach was owned by a single landowner or consisted of very similar geomorphic characteristics. Within those project opportunity areas, restoration actions that could occur in that area were identified and the action number entered into column A of the opportunities worksheet. The action names associated with the action numbers were then automatically generated in column B, and some of the other variables would self-populate. Figure 10 shows an example of this first step and illustrates the additional steps necessary to complete a project opportunity.

Figure 10. Example Completed Opportunity Scoring Worksheet with Explanations



LAS-7

Action #	Opportunity & Activity Name	Action Type	Biological Ranking Inputs: BSR ranking	Limiting Factors (Quantity & Priority Addressed)	Restoration Action Priority	Climate Change	Natural Process (Beechie et al)	Outputs: Total Biological Benefit Score
	Opportunity: Pete King Road to Trail		Tier 1				Partial Restoration	
			0	3	4	1	5	13
18	Riparian Buffer Strip, Planting	Direct Action		16	5	6		27
20	Remove non-native plants	Direct Action		11	10	2		23
22	Barrier or culvert replacement/removal	Direct Action		2	10	2		14
35	Road Decomissionsing or abandonment	Direct Action		5	10	2		17
	0	Direct Action		0	0	0		0
	0	Direct Action		0	0	0		0
	Opportunity: Pete King Beaver Dam Analog		Tier 1				Partial Restoration	
			0	1	1	1	5	7
16	Beaver Restoration Management	Passive Effect		11	5	8		24
	0	Direct Action		0	0	0		0
	0	Direct Action		0	0	0		0
	Opportunity: Pete King Creek 418 Culvert		Tier 1				Partial Restoration	
			0	4	4	1	5	13
18	Riparian Buffer Strip, Planting	Direct Action		16	5	6		27
20	Remove non-native plants	Direct Action		11	10	2		23
22	Barrier or culvert replacement/removal	Direct Action		2	10	2		14
33	Reduce - Mitigate Point Source Impacts	Direct Action		8	10	0		18
	0	Direct Action		0	0	0		0
	0	Direct Action		0	0	0		0
	0	Direct Action		0	0	0		0

The process of completing the project opportunity biological ranking components within the Opportunity Matrix worksheet continued as follows:

Action Type: While the majority of action types were direct actions, the Atlas Development Team thought it would be useful to identify whether a restoration action type had a passive effect; therefore, this category was added into the Opportunity Prioritization matrix as a drop-down item (see Figure 10, Step 2). The selection of an action as a passive effect helps address situations where only a few limited physical actions might be implemented (such as a project opportunity which only requires an easement, or beaver restoration management), but selecting some actions as having a passive effect represents greater benefit for larger scale restoration opportunities. For example, if removing a levee (Action 7) also contributes to the restoration of floodplain connectivity, then Action 9 (Restoration of Floodplain Topography and Vegetation), Action 11 (Perennial Side Channel), and Action 12 (Secondary [non-perennial] Channel) could also be selected as a passive effect, and thus give credit to those indirect actions. While most restoration actions were direct actions, this category helped highlight more passive actions such as the Protect Land and Water, Riparian Fencing, and Beaver Restoration Management.

BSR Ranking: The BSR ranking for each opportunity was included as the first category within the biological rankings. This ranking sets up the initial hierarchy for ranking projects relative to each other and is based on the assumption that project opportunities within higher ranked (Tier I) BSRs should be pursued first. Precedence for this strategy is found in *Setting River Restoration Priorities: A Review of Approaches and a General Protocol for Identifying and Prioritizing Actions* (Beechie et al. 2008). Within the opportunity worksheet, the previously determined BSR rankings were selected as Tier I, Tier II, or Tier III from a drop-down menu (Figure 10, step 3). Under this system, it is possible for a project opportunity in a Tier III BSR to have a higher opportunity score than an opportunity in a Tier I BSR, but that higher score does not override the initial hierarchy.

Limiting Factor Score: This category was scored based on the ability of project restoration actions to address the limiting factors that had been previously identified and ranked as High, Medium, or Low (see Section II.4). The scores in this category accounted for both direct and indirect impacts that a restoration action could have on limiting factors. For example, a levee removal project can directly affect Peripheral and Transitional Habitats: Floodplain Condition (NOAA limiting factor 5.2), but indirectly affect other limiting factors, such as Riparian Condition (NOAA limiting factor 4.1) and Channel Structure & Form (NOAA limiting factors 6.1 and 6.2). To account for the greater benefit anticipated with direct impacts, the limiting factors' rating (High, Medium, Low) and impact type was scored as shown in Table 1.

Table 1. Limiting Factors Ratings, Impact Type, and Scores

Limiting Factor Rating	Impact Type	Score
High	Direct	5
High	Indirect	3
Medium	Direct	3
Medium	Indirect	2
Low	Direct	2
Low	Indirect	1

Using this scoring system, each restoration action was then automatically scored based on the number and priority of limiting factors that it addressed, and whether it was primarily a direct or indirect impact. In this fashion, the more restoration actions within an opportunity that were

identified, combined with limiting factors having direct impacts, could result in a very large cumulative score. Therefore, the cumulative score of all limiting factors was divided by a factor of 10 to better align with the ranges of the other scoring categories.

Restoration Action Priority Score: For each potential action entered into a project opportunity site, the opportunity scoring worksheet automatically tallied biological scores based on the previous qualitative rating of the restoration action's importance (see Section III.5 and Figure 7), by converting the High, Medium, Low, or N/A rankings into scores of 10, 5, 2, or 0, respectively, as illustrated in the Restoration Action Priority score in Figure 10 (column 6). If a large number of restoration actions within an opportunity were identified, it could result in a very large cumulative score; therefore, the cumulative Restoration Action Priority score was divided by a factor of 10 to better align with the ranges of the other scoring categories.

Climate Change Score: Within the opportunity matrix worksheet, a Climate Change Score was automatically tallied for each restoration action based on its ability to ameliorate temperature increases, base flow decreases, and peak flow increases, and its capacity to increase salmon resilience. Scoring is based on criteria described in *Restoring Salmon Habitat for a Changing Climate* (Beechie et al. 2012), with up to 8 points available for any given restoration action. Consistent with the other scoring categories, the cumulative Climate Change score was also divided by a factor of 10.

Natural Processes Score: This score prioritizes the opportunity as a whole and is based on the assumption that restoration of natural processes (full restoration) is preferred over partial restoration or habitat creation. Restoration opportunities that have the ability to restore processes that create and maintain habitats and biota are more beneficial than those that can only improve the quality of habitat by treating specific symptoms through the creation of locally appropriate habitat types. Precedence for this approach is found in *Process-based Principles for Restoring River Ecosystems* (Beechie et al. 2010). Within the opportunity matrix worksheet, the Natural Processes score was selected from a drop-down menu (Figure 10, step 4). The action class, definition, and resulting scores used in this category are shown in Table 2.

Table 2. Natural Processes Action Classes, Definitions, and Scores

Action Class	Definition	Score
Full Restoration	Restore processes that create and maintain habitats and biota, thereby returning a river ecosystem to its normative state.	10
Partial Restoration	Restore or improve selected ecosystem processes, thereby partially restoring a riverine ecosystem.	5
Habitat Creation	Improve quality of habitat by treating specific symptoms through creation of locally appropriate habitat types; used where causes of degradation cannot be addressed.	2.5

After entering all the required information, the total Biological Benefit Score for that opportunity was summed for the project opportunity. The sequence was repeated for additional opportunities within each BSR, until the entire stream network, and in some cases adjacent upland areas, was completed for each area of the watershed. It is important to acknowledge that project opportunity scores are relative and should *not* be considered absolute scores for sequential project implementation, but should guide project implementers in determining which restoration opportunities should be pursued first.

III.9 PROJECT FEASIBILITY

Up to this point, project opportunities were scored and ranked based solely on biological benefit. Implementation of restoration actions, especially on private land, is often constrained by other factors. Therefore, a project feasibility scoring system was developed and kept as a separate but important component that must be considered before advancing a project opportunity to the project proposal, funding, and implementation stages. Within the Lochsa Prioritization Matrix spreadsheet, feasibility criteria were incorporated alongside the Biological Benefit Score to more accurately evaluate the implementation potential of a project opportunity. While the nine variables chosen by the Lochsa Implementation Team represent a comprehensive list (as illustrated in Figure 11 below), it was generally agreed that the most important among these was Landowner/Public Willingness. If a high ranking opportunity from a biological perspective cannot be pursued because of a landowner's unwillingness to participate or, in the case of USFS land in the Lochsa River Watershed, the public's unwillingness to support a potential project, then the remaining variables have little meaning. For that reason, along with challenges with respect to the objective assignment of a quantitative score for each criterion, the Feasibility Criteria were left as qualitative ratings (Yes or No; High, Medium, Low, and To Be Determined [TBD]).

Feasibility variables were not evaluated for each and every opportunity; instead, the Atlas Development Team decided it would be better to complete those once an opportunity advanced toward implementation. Opportunities that were not fully evaluated for feasibility were rated using the default category of TBD in the Overall Feasibility Rating column. For those opportunities that were rated for feasibility, the comments area allowed for documentation of specific reasons why a project may rank low for any particular feasibility variable. This documentation provides project implementers the rationale behind decisions not to pursue or to defer opportunities, and this justification can be presented to funding agencies and reviewers (i.e., BPA and the ISRP) to answer the potential question "Why was the most highly ranked opportunity not pursued?" It is important to note that the Feasibility Criteria ratings did not have any impact on the Biological Benefit Score (i.e., it does not move any project lower or higher on the list).

Figure 11. Example Feasibility Rankings

Lochsa Opportunities Summary, October 2016													
Basic Information				**Feasibility Criteria**									
Opportunity Name	**Status**	**BSR**	**BSR ranking**	**Landowner/Public Willingness**	**Partnership Capacity**	**Environmental Compliance (NEPA, ESA, NHPA)**	**Site Access**	**Construction Feasibility (Cost, Complexity)**	**Project Timing (Contract Periods, Planning, Funding)**	**Probability (Biolocial Goals and Objectives)**	**Probability (Public Safety Goals and Objectives)**	**Overall Feasibility Rating**	**Comments**
BSR: LAS-3a													
Opportunity: entire BSR (Western Pacific Land Acquisition)	**Active**	BSR: LAS-3a	Tier I	TBD	TBD	TBD	H	TBD	TBD	H	H	TBD	Conservation entity pursuing negotiation with Western Pacific and Forest Service
Opportunity: Pack Creek 5671 re-meander	**Active**	BSR: LAS-3a	Tier I	H	H	H	H	M	H	H	H	H	Covered by CE, Proceed with survey and design in 2017 contract
Opportunity: Pack Creek-Packer Meadows 373	**Active**	BSR: LAS-3a	Tier I	H	M	M	H	M	M	H	H	TBD	Potential NEPA (EA) and design in 2018, continuing conversation about integration
Opportunity: South Brushy Road Decommission - Section 8	**Active**	BSR: LAS-3a	Tier I	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	Survey in 2016 (approximately 10 miles)
Opportunity: South Brushy Road Decommission- Section 10	**Active**	BSR: LAS-3a	Tier I	TBD	TBD	TBD	H	TBD	TBD	H	H	TBD	Currently surveyed in 2016, potential implementation in 2018 +, focused EA for NEPA, potential combination with timber harvest? Karen will check with Tam White from Timber
Opportunity: South Brushy Road Decommission - Section 16	**Closed**	BSR: LAS-3a	Tier I	H	H	H	H	H	H	H	H	H	Completed in 2016
Opportunity: South Brushy Road Decommission - Section 14	**Not started**	BSR: LAS-3a	Tier I									TBD	
Opportunity: Spruce Creek LWD addition	**Not started**	BSR: LAS-3a	Tier I									TBD	
Opportunity: Lolo Pass HWY sediment reduction	**Not started**	BSR: LAS-3a	Tier I									TBD	
Opportunity: S.Fork Spruce Culvert replacement	**Not started**	BSR: LAS-3a	Tier I									TBD	
Opportunity: Skookum Lake road sediment reduction	**Not started**	BSR: LAS-3a	Tier I									TBD	
Opportunity: Shotgun Creek 5637 road Culvert replace/remove	**Not started**	BSR: LAS-3a	Tier I									TBD	
Opportunity: Shotgun Creek South road decommission	**Not started**	BSR: LAS-3a	Tier I									TBD	
Opportunity: Brushy Fork Culverts road 5669	**Not started**	BSR: LAS-3a	Tier I									TBD	
Opportunity: Cherokee Creek Replacement/removal	**Not started**	BSR: LAS-3a	Tier I									TBD	
Opportunity: Swede Creek Culvert Replacement	**Not started**	BSR: LAS-3a	Tier I									TBD	
Opportunity: Russian Creek Highway 12 Culvert Replacement	**Not started**	BSR: LAS-3a	Tier I									TBD	

Section IV MATRIX TOOL ADAPTATIONS

This section discusses some of the adaptations that were made to the matrix tools based on lessons learned from previous versions of Atlas development and implementation in other regions (BPA 2017), and in considering conditions specific to the Lochsa River Watershed. Modifications or improvements made to the BSR or opportunity matrices based on Atlas Development Team discussions of various approaches are discussed below.

IV.1 BSR MATRIX ADAPTATIONS

The Lochsa Atlas Development Team considered whether or not the P-score values should be weighted equally between the four focal species (multi-species with equal emphasis), or alternatively, assigning higher weightings to more imperiled species, as was done in the Upper Grande Ronde River Atlas, in which Chinook salmon were considered to be the more imperiled species and were assigned a greater weight than steelhead or bull trout (BPA 2017). The Lochsa Atlas Development Team determined that using a multi-species with equal emphasis approach, and assigning equal weighting to all four species, was the best approach in the Lochsa River Watershed since they determined that no single species was significantly more imperiled than the others.

With respect to fish life stage utilization, the Atlas Development Team adopted the methods used in the Upper Grande Ronde River Atlas in that scoring of fish life stage utilization was done for all four focal species (steelhead, Chinook salmon, bull trout, and lamprey), as opposed to scoring only the most imperiled species (such as Chinook salmon as was done in the Catherine Creek Atlas). The team determined a multi-species scoring approach would be the most appropriate strategy for the Lochsa River Watershed. Based on that decision, all life stages of all four species were rated and scored as described in Section III.2 and III.6.1.

IV.2 OPPORTUNITY MATRIX ADAPTATIONS

Building upon the strategy used in the Upper Grande Ronde River Atlas, the Lochsa Atlas Development Team reviewed the EP lists and weightings of NOAA limiting factors and determined that in nearly all cases they fell short of what was required at the BSR level because many limiting factors were not listed. In most BSRs, between 2 and 12 limiting factors were added to the original EP lists. This approach provided more criteria to evaluate and rate at the project opportunity level.

Unlike the approach used in either the Catherine Creek or the Upper Grande Ronde River Atlas, the Lochsa Atlas Development Team decided there was little value in rating restoration actions based on immediate- or long-term effects. As the previous restoration action rating system created confusion, these two ratings were combined into a single score with clearer definitions that still addressed the time frame in which actions should be implemented.

A new tool to aid in making sound management decisions was the addition of a climate change score. As noted in Section III.8, this tool scores a restoration action based on its ability to ameliorate temperature increases, base flow decreases, and peak flow increases, and its capacity to increase salmon resilience (Beechie et al. 2012). Another modification included new columns within each Restoration Prioritization Worksheet to document information sources for fish periodicity, life stage

utilization, and limiting habitat factors. This was accomplished by selecting the choice of Data, Opinion, or Not Applicable from a drop-down menu, and providing additional notes in the Comments column, such as literature cited or empirical data referenced.

Lastly, because water rights or withdrawals on the Lochsa River Watershed are unregulated, two water-related scores (water rights date and water rights flow rate) were removed from the Lochsa Atlas scoring system.

Section V RESULTS AND NEXT STEPS

This section describes the final rankings of BSRs and summarizes project opportunity scoring in the Lochsa River Watershed based on the previously described physical and biological scoring criteria, followed by concluding remarks and next steps.

V.1.1 BSR Rankings and Project Opportunity Scores

Within the Lochsa Prioritization Matrix spreadsheet, the final rankings for the nine BSRs in the Lochsa River Watershed were summarized in an Opportunity Summary spreadsheet. The results showed that BSR LAS-3a stood out above the rest with a cumulative score of 96, followed by LAS-1a, LAS-7, and LAS-2a, with scores of 86, 82, and 77, respectively. The Atlas Development Team designated these four BSRs as Tier I areas. BSRs LAS-3b and LAS-6, with scores of 69 and 68, respectively, were designated as Tier II areas. BSRs LAS-2b and LAS-9 scored considerably lower (46 and 38, respectively) and were assigned Tier III rankings (Table 3).

Table 3. Lochsa River Watershed BSR Scores and Final Rankings

BSR Number	Qualitative Inputs for Ability to Affect Change			Species Impact Scores		Ability to Affect Change Scores		Results	
	Geomorphic Potential Classification	Current Habitat Condition Classification	Current Temperature	U-Score (Critical fish use)	P-Score (Fish life stages present)	Geomorphic Potential Score	Current Habitat Condition Score	Cumulative Score	Ranking (Tier I, II, III)
LAS-3a	High	Fair	Good	18	25	25	28	96	Tier I
LAS-1a	Medium	Good	Good	18	25	15	28	86	Tier I
LAS-7	High	Fair	Fair	15	17	25	25	82	Tier I
LAS-2a	Medium	Good	Good	9	25	15	28	77	Tier I
LAS-3b	Medium	Good	Excellent	8	16	15	30	69	Tier II
LAS-6	Low	Good	Fair	11	27	5	25	68	Tier II
LAS-8	Low	Good	Excellent	6	18	5	30	59	Tier II
LAS-2b	Low	Excellent	Excellent	6	25	5	10	46	Tier III
LAS-9	Low	Excellent	Excellent	6	17	5	10	38	Tier III

A total of 54 project opportunities were scored in October 2016, and each was assigned a status of "Not Started," "Active," "On Hold," or "Closed" from a drop-down menu. There were 39 project opportunities within the Tier I BSR category, 12 project opportunities within the Tier II category, and 3 project opportunities listed within the Tier III category. Project opportunities ranged in size from less than a tenth of a mile to several miles along the stream. Project opportunity scores ranged from a low of 6 to a high score of 17. The results are presented in Appendix B.

It is expected that these opportunity lists will be dynamic and adaptively managed over time. Landowners or land managers may not fully approve all proposed restoration actions on their land which would require opportunities to be re-scored and as overall opportunity status changes (projects are completed and/or new opportunities are added over time). Other Lochsa Atlas products,

including GIS data and high level and detailed concept maps of project opportunities, will be housed by the Atlas Development Team, with some information available on the Lochsa River Atlas Development and Implementation Team website.

V.1.2 Summary and Next Steps

The primary products of the Lochsa Atlas include prioritized BSRs, ranked lists of opportunities within those BSRs, and high-level maps of restoration opportunities. These products should not be viewed as static or fixed, but rather as useful tools to assist restoration practitioners and managers in ensuring the correct restoration actions are implemented in the areas that can address the most limiting factors, and produce the highest potential benefits for salmonid populations. Restoration actions are identified and implemented with the understanding that conditions can change over time based on new information, including empirical data, published research evidence, and local knowledge, as it becomes available.

The Lochsa Atlas provides a useful, evidenced-based framework for restoration planners, practitioners, and funders. It is important to remember that a ranked conceptual project opportunity does not represent a "project" until it has been reviewed and approved by the landowner and the funding entities. The Lochsa Atlas provides a long-term, strategic action plan to pursue restoration opportunities transparently and objectively within the highest priority areas of the watershed. Once an opportunity has received landowner approval and becomes a project, it is intended to be evaluated by the Lochsa Atlas Implementation Team to determine the best time frame for funding and implementation.

The Lochsa Atlas provides a strategic approach that facilitates the allocation of funds to the most biologically beneficial restoration actions within the highest priority areas of the Lochsa River Watershed. Lochsa Atlas products include maps of restoration opportunities along with a biologically based scoring and ranking system, vetted through an open and transparent evaluation of best available data by a large and well-represented multi-agency Atlas Development Team.

The Lochsa Atlas provides a scientifically defensible rating, ranking, and prioritization framework for restoration projects, and incorporates continuous adaptive management. It also provides an objective scoring rationale that can be used in communication with landowners and agencies who participate in habitat restoration. It should be noted, however, that a highly ranked project opportunity should be distinguished from an actual project, which requires additional review by the Lochsa Atlas Implementation Team as well as landowner or agency approval. Additional guidance will be developed through a *Lochsa Atlas Implementation Guidelines* document that will provide additional information on the procedures to be used for advancing a project from the opportunity stage to project proposal and implementation stages. It will also include information on public outreach, engagement of regulatory partners that should occur in conjunction with Lochsa Atlas implementation, as well as details on how and when the Lochsa Atlas will be adaptively managed and updated over time.

Lochsa Atlas tools will remain flexible and adaptable; updates will be made as limiting factors or river conditions change, as fish life stage utilization of habitat changes, as new empirical data and research evidence become available, or as projects are implemented (i.e., removed from the ranking list), thus

contributing to the adaptive management of habitat restoration programs into the future. Regularly scheduled reviews, with potential updates, through the annual State of the Science meetings will ensure that the Lochsa Atlas serves as a "living" document now and well into the future.

Section VI REFERENCES

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APPENDIX A – RESTORATION ACTION EXPLANATIONS

Restoration Action Group	Action No.	Action	Explanations
Dedicating Land & Water to the Preservation & Restoration of Stream Habitat	1	Protect Land and Water (Easement, Acquisition)	Includes various types of easements, leases, or land acquisitions. May also include land management plans if they are protective and long term.
Channel Modification	2	Channel Reconstruction	Actions in this category generally involve active construction with heavy equipment. Pool development includes pool construction, or actions to deepen pools but should not be confused with # 27 - LWD Placement. Meander (Oxbow) Re-connect may include less aggressive approaches such as excavating the inlet of remnant channels.
	3	Pool Development	
	4	Riffle Construction	
	5	Meander (Oxbow) Re-connect - Reconstruction	
	6	Spawning Gravel Cleaning and Placement	
Floodplain Reconnection	7	Levee Modification: Removal, Setback, Breach	Actions 7 and 8 are self-explanatory. Confusion surrounding Action 9 centered on excavation versus activation of the floodplain by other means, and what role vegetation played. The key point is that this action increases flood inundation which likely leads to more riparian vegetation. Action 10 refers to excavation of floodplain benches either in existing or new channels when full floodplain restoration is not possible.
	8	Remove – Relocate Floodplain Infrastructure	
	9	Restoration of Floodplain Topography and Vegetation	
	10	Floodplain Construction	
Side Channel / Off-Channel Habitat Restoration	11	Perennial Side Channel	Actions 11 and 12 may include constructing, restoring connectivity, or enhancing existing channels. Action 13 includes both ponds *and* wetlands, with ponds usually being constructed while wetlands may either be enhanced or constructed. Action 15 refers to hyporheic (sub-surface) water/flow; it can be a result of the other actions listed, or created through construction of groundwater galleries
	12	Secondary (non-perennial) Channel	
	13	Floodplain Pond – Wetland	
	14	Alcove	
	15	Hyporheic Off-Channel Habitat (Groundwater)	
	16	Beaver Restoration Management	
Riparian Restoration & Management	17	Riparian Fencing	Riparian Fencing usually is interpreted to mean fencing to exclude livestock, not riparian pastures. Action 19 should only be done to accelerate natural riparian succession (not for forestry/timber harvest goals).
	18	Riparian Buffer Strip, Planting	
	19	Thinning or removal of understory	
	20	Remove non-native plants	
Fish Passage Restoration	21	Dam removal or breaching	Structural Passage (Diversions) may include the addition of fish screens to unscreened irrigation diversions, measures to ensure that all life stages of fish can pass channel spanning irrigation diversions, or removal of diversions altogether.
	22	Barrier or culvert replacement/removal	
	23	Structural Passage (Diversions)	
Nutrient Supplementation	24	Addition of organic and inorganic nutrients	This was always used with regard to additions of organic nutrients via fish carcasses.
Instream Structures, LWD/Logjams	25	Rock Weirs	The use of Rock Weirs was generally considered as an "old school" technique, but remains as an action since they can still be a tool to restore gradient where avulsions or incision occur. LWD includes all types and may be soft placed or engineered, with multiple objectives (enhance or create pools, bank stability, etc.)
	26	Boulder Placement	
	27	LWD Placement	
Bank Restoration, Modification, Removal	28	Modification or Removal of Bank Armoring	Action 28 includes rip rap, concrete, etc. Action 29 includes use of live plant material such as willow cuttings.
	29	Restore banklines with LWD – Bioengineering	
Water Quality – Quantity Impacts	30	Acquire Instream Flow (Lease- Purchase)	Most of these actions were self-explanatory. Action 31 could include cold water seeps (without a surface water connection), or warm water for winter rearing. Action 34 might include juniper/conifer thinning, fire management activities, reseeding. For Action 35 road decommissioning may involve regrading to natural contours. Action 36 refers to activities primarily related to sediment reduction and return flow in channels.
	31	Improve Thermal Refugia (spring reconnect, other)	
	32	Irrigation System Upgrades -Water Management	
	33	Reduce - Mitigate Point Source Impacts	
	34	Upland Vegetation Treatment - Management	
	35	Road Decommissioning or abandonment	
	36	Road Grading - Drainage Improvements	

APPENDIX B – LOCHSA RIVER WATERSHED PROJECT OPPORTUNITY RESULTS

Lochsa Opportunities Summary, October 2016								
Basic Information				Biological Criteria				
Opportunity Name	Status	BSR	BSR ranking	Limiting Factors (Priority & Quantity Addressed)	Restoration Action Priority	Climate Change	Natural Process (Beechie et al. 2010)	Total Biological Benefit Score
BSR: LAS-1a								
Opportunity: Waw'aa'lamnime Wood Addition	**Not started**	BSR: LAS-1a	Tier I	1	1	0	5	7
Opportunity: Music Line Channel Relocation	**Not started**	BSR: LAS-1a	Tier I	5	1	1	5	12
Opportunity: Doe Creek Wood Addition	**Not started**	BSR: LAS-1a	Tier I	1	1	0	5	7
Opportunity: Western Pacific Land Acquisition	**Not started**	BSR: LAS-1a	Tier I	2	1	1	5	9
BSR: LAS-2a								
Opportunity: 111 Road Decommissioning	**Not started**	BSR: LAS-2a	Tier I	4	3	1	5	14
Opportunity: Walton Creek Hatchery Intake	**Not started**	BSR: LAS-2a	Tier I	0	0	0	5	6
Opportunity: Beave Ridge Road 368 Improvement	**Not started**	BSR: LAS-2a	Tier I	1	1	0	5	7
Opportunity: 111 Road Culvert Replacement/Removal	**Not started**	BSR: LAS-2a	Tier I	4	4	1	5	14
Opportunity: Road 359 and 360 Road Improvement	**Not started**	BSR: LAS-2a	Tier I	3	3	0	5	11
Opportunity: Elk Summit Road	**Not started**	BSR: LAS-2a	Tier I	3	3	0	5	11
Opportunity: Western Pacific Land Acquisition	**Not started**	BSR: LAS-2a	Tier I	3	1	1	5	10
BSR: LAS-2b								
Opportunity: Elk Summit Road Improvement	**Not started**	BSR: LAS-2b	Tier III	3	1	0	5	9
BSR: LAS-3a								
Opportunity: entire BSR (Western Pacific Land Acquisition)	**Active**	BSR: LAS-3a	Tier I	3	1	1	5	10
Opportunity: Pack Creek 5671 re-meander	**Active**	BSR: LAS-3a	Tier I	1	1	0	5	7
Opportunity: Pack Creek-Packer Meadows 373	**Active**	BSR: LAS-3a	Tier I	4	1	1	5	11

Lochsa Opportunities Summary, October 2016								
Basic Information				Biological Criteria				
Opportunity Name	Status	BSR	BSR ranking	Limiting Factors (Priority & Quantity Addressed)	Restoration Action Priority	Climate Change	Natural Process (Beechie et al. 2010)	Total Biological Benefit Score
Opportunity: South Brushy Road Decommission - Section 8	**Active**	BSR: LAS-3a	Tier I	1	2	0	5	9
Opportunity: South Brushy Road Decommission- Section 10	**Active**	BSR: LAS-3a	Tier I	1	2	0	5	9
Opportunity: South Brushy Road Decommission - Section 16	**Closed**	BSR: LAS-3a	Tier I	1	2	0	5	9
Opportunity: South Brushy Road Decommission - Section 14	**Not started**	BSR: LAS-3a	Tier I	1	2	0	5	9
Opportunity: Spruce Creek LWD addition	**Not started**	BSR: LAS-3a	Tier I	1	1	0	5	7
Opportunity: Lolo Pass HWY sediment reduction	**Not started**	BSR: LAS-3a	Tier I	4	3	1	5	13
Opportunity: S. Fork Spruce Culvert replacement	**Not started**	BSR: LAS-3a	Tier I	4	3	1	5	13
Opportunity: Skookum Lake road sediment reduction	**Not started**	BSR: LAS-3a	Tier I	2	2	0	5	10
Opportunity: Shotgun Creek 5637 road Culvert replace/remove	**Not started**	BSR: LAS-3a	Tier I	1	1	0	5	7
Opportunity: Shotgun Creek South road decommission	**Not started**	BSR: LAS-3a	Tier I	3	4	1	5	13
Opportunity: Brushy Fork Culverts road 5669	**Not started**	BSR: LAS-3a	Tier I	6	5	1	5	17
Opportunity: Cherokee Creek Replacement/removal	**Not started**	BSR: LAS-3a	Tier I	6	5	1	5	17
Opportunity: Swede Creek Culvert Replacement	**Not started**	BSR: LAS-3a	Tier I	6	5	1	5	17
Opportunity: Russian Creek Highway 12 Culvert Replacement	**Not started**	BSR: LAS-3a	Tier I	6	5	1	5	17
BSR: LAS-3b								
Opportunity: Boulder - Crooked Creek Road Improvement/Decommissioning	**Not started**	BSR: LAS-3b	Tier II	4	4	1	5	14

Lochsa Opportunities Summary, October 2016								
Basic Information				Biological Criteria				
Opportunity Name	Status	BSR	BSR ranking	Limiting Factors (Priority & Quantity Addressed)	Restoration Action Priority	Climate Change	Natural Process (Beechie et al. 2010)	Total Biological Benefit Score
Opportunity: Western Pacific Land Acquisition	**Not started**	BSR: LAS-3b	Tier II	3	1	1	5	10
BSR: LAS-6								
Opportunity: Powell Creek Culvert	**Not started**	BSR: LAS-6	Tier II	2	1	1	5	9
Opportunity: Weir Creek Vault Toilet Installation	**Not started**	BSR: LAS-6	Tier II	4	1	1	5	11
Opportunity: Major Fenn Side Channel Reconnection	**Not started**	BSR: LAS-6	Tier II	5	2	2	5	13
Opportunity: Lochsa Roadside Weed Treatment	**Not started**	BSR: LAS-6	Tier II	1	0	0	5	6
Opportunity: Mink Creek Highway 12 Culvert Replacement	**Not started**	BSR: LAS-6	Tier II	5	2	1	5	13
Opportunity: ITD Tumble Creek to Lochsa RS Highway Improvement	**Not started**	BSR: LAS-6	Tier II	6	2	2	5	15
BSR: LAS-7								
Opportunity: Pete King Road to Trail	**On Hold**	BSR: LAS-7	Tier I	3	4	1	5	13
Opportunity: Pete King Beaver Dam Analog	**Closed**	BSR: LAS-7	Tier I	1	1	1	5	7
Opportunity: Pete King Creek 418 Culvert	**Active**	BSR: LAS-7	Tier I	4	4	1	5	13
Opportunity: Pete King Trib Culvert on 101	**Active**	BSR: LAS-7	Tier I	4	4	1	5	13
Opportunity: Polar Creek Culvert on 101	**Active**	BSR: LAS-7	Tier I	4	4	1	5	13
Opportunity: Walde Creek Trib culvert on 101	**Active**	BSR: LAS-7	Tier I	4	4	1	5	13
Opportunity: Canyon Creek 445 Road to Trail	**On Hold**	BSR: LAS-7	Tier I	3	4	1	5	13
Opportunity: West Fork Deadman 5541 Culvert	**Active**	BSR: LAS-7	Tier I	4	4	1	5	13
Opportunity: 460-B Road Decommissioning	**Active**	BSR: LAS-7	Tier I	2	2	1	5	10

Lochsa Opportunities Summary, October 2016								
Basic Information				Biological Criteria				
Opportunity Name	Status	BSR	BSR ranking	Limiting Factors (Priority & Quantity Addressed)	Restoration Action Priority	Climate Change	Natural Process (Beechie et al. [illegible])	Total Biological Benefit Score
Opportunity: Mouth of Canyon Creek Mine Rehabilitation	**Active**	BSR: LAS-7	Tier I	1	1	0	5	7
Opportunity: Van Camp Trail Improvement	**Active**	BSR: LAS-7	Tier I	3	4	1	5	12
BSR: LAS-8								
Opportunity: 107 Road Relocation/Improvement (Graves Creek)	**Not started**	BSR: LAS-8	Tier II	3	4	2	5	13
Opportunity: Very Lost Creek road decommissioning/improvement	**Not started**	BSR: LAS-8	Tier II	2	3	1	5	11
Opportunity: Bimmerick Meadow Restoration	**Not started**	BSR: LAS-8	Tier II	2	3	1	5	11
Opportunity: McClendon Butte Trail Improvement	**Not started**	BSR: LAS-8	Tier II	2	3	1	5	11
BSR: LAS-9								
Opportunity: Fish Lake Inlet Channel Restoration	**Not started**	BSR: LAS-9	Tier III	4	1	1	5	11
Opportunity: Backcountry Trail Weed Treatment	**Not started**	BSR: LAS-9	Tier III	1	1	0	5	6